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Report to Rep. Thomas Beville, Chairman, House Committee on Appropriations: Public Works Subcommittee; by Elser B. Staats, Comptroller General.

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Congressional Relevance: House Committee on Appropriations: Public Works Subcommittee; House Committee on Interior and Insular Affairs; Senate Committee on Environment and Public Works. Rep. Thomas Beville.

The only plant in the United States that is capable of producing heavy water is the one at the Department of Energy's (DOE's) installation at Savannah River, South Carolina. There has been uncertainty in the past few years about the present and potential demand for heavy water and the best way to operate the plant to meet that demand. Two options for meeting current demands for heavy water were to operate the plant at about one-third capacity or to run one-third of the plant at full capacity and shut down the remainder. DOE chose the first option, although it was economically inefficient, in order to maintain the capability for maximum production. Potential areas for future demand listed by DOE were nuclear reactors, a pharmaceutical firm, and additional military requirements. Continuing to operate the plant under the current option cannot be justified because a possible sale to the New Brunswick Electric Power Commission has been negated, the potential sale to the pharmaceutical firm has diminished, and the plant would not be able to meet potential military demand. DOE should choose an alternative and the Subcommittee should require DOE to advise it of the decision and justifications as soon as possible. (HTW)

5571



COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON, D.C. 20548

B-164105

MAR 1978

The Honorable Thomas Bevill  
Chairman, Subcommittee on  
Public Works  
Committee on Appropriations  
House of Representatives

Dear Mr. Chairman:

As agreed with your office, we have looked into the operation of the heavy water plant at the Department of Energy's (DOE's) installation at Savannah River, South Carolina. This plant, which is operated for DOE by E. I. du Pont De Nemours, has been producing heavy water since 1953. Heavy water--which resembles ordinary water but is 10 percent denser--is used in some reactors, has certain military applications, and to a lesser extent, is used in research.

For the last several years, there has been uncertainty surrounding the operations of the heavy water plant. This uncertainty centers around the demand for heavy water--now and in the future--and the best way to operate the plant to meet that demand.

HISTORY OF HEAVY WATER PLANTS  
IN THE UNITED STATES

The only plant in the United States that is capable of producing heavy water is located at Savannah River. During the early 1950s, the then Atomic Energy Commission built and operated two heavy water plants that together produced about 850 metric tons per year. The heavy water produced was primarily used for defense purposes--(1) in three Government-owned nuclear reactors that produce plutonium for nuclear weapons and (2) as a material in nuclear weapon components.

By 1959, one heavy water plant and portions of the second plant were dismantled because the defense demand for heavy water decreased. Between 1959 and September 1976, about 195 tons per year were produced at the remaining Savannah River Plant. Much of the heavy water produced during this period

was sold to foreign countries primarily for use in their power reactors. In fact, from 1968 through 1973, foreign sales exceeded production; the shortfall was made up by using inventories of heavy water that had been accumulated in earlier years. Since then, foreign customers have either developed their own capacity to produce heavy water or have found other sources.

In the fall of 1976, the heavy water plant began operating at one-third capacity, producing about 65 tons per year. The 65 metric ton per year production rate was established to meet what was considered current demand while maintaining the lowest practical operational level for producing heavy water. DOE says that lower production levels are technically not feasible.

### THE OPTIONS AND THE CHOICE

Two options for producing 65 tons per year were available to DOE in the fall of 1976. The first option involved operating the plant at about one-third capacity. The second involved running about one-third of the plant at full capacity and shutting down the remaining two-thirds.

There were two key factors DOE considered in choosing an operating option. One factor was whether demand for heavy water would increase in the future. If demand for heavy water increased, the first option (operating the entire plant at reduced capacity) would enable DOE to increase production with minimum effort and cost because the entire plant was operating at reduced capacity. Conversely, the second option (shutdown of about two-thirds of the plant) would require substantial restart costs to essentially rebuild or retrofit the shutdown units to meet the increased demand. According to DOE officials, if plant components remain shut down for longer than 6 months, severe deterioration and corrosion occur that render the equipment essentially useless.

The second key factor was the cost of operating the plant for each option. Several analyses were made by DOE and its contractor that reached the same conclusion--option two could save DOE between \$2 million and \$6 million annually. The range (\$2-\$6 million) is attributable to various methods that could be used to shut down the plant.

DOE decided that the first option was better because (1) the units would not deteriorate, thus allowing DOE to firm up the heavy water demand, which was uncertain at that time and (2) capability to achieve maximum production would

be preserved. In reaching this decision, DOE recognized that this option was economically inefficient.

### GAO'S ANALYSIS OF DOE'S DECISION

The pivotal consideration involved in deciding which operating option is preferable relates to the demand for heavy water--now and in the future. Estimates of future demands through 1989, which DOE considers firm, can be met by producing 65 tons each year. Most of this firm demand is related to military requirements.

The question, then, is why did DOE decide in October 1976 to operate the plant at the more expensive option when the less expensive option would produce the needed amounts. The answer is that DOE believed there were significant potential future demands for heavy water that, if materialized, would require the entire plant to be brought up to full capacity. Consequently, if the less expensive option was adopted, restarting the entire plant to meet these demands is estimated to cost anywhere from about \$40 to \$100 million. In making the decision, DOE stated that the actual demand picture was expected to be clarified within the next 2 to 3 years.

An October 7, 1976, DOE memorandum on the option decision listed the potential areas where demand for heavy water might materialize. These areas, which are analyzed in the next several sections, were: nuclear reactors, a pharmaceutical firm, and additional military requirements beyond those considered firm.

#### Nuclear reactors

This potential demand refers to so-called heavy water power reactors which use heavy water rather than ordinary water as a coolant and moderator. Because there are no commercial heavy water power reactors in the United States DOE was addressing a potential demand from Canada, which does have heavy water reactors and plans to build more of them. DOE had received an inquiry for heavy water from the New Brunswick Electric Power Commission and negotiated a tentative price on July 30, 1976. As a result of this negotiation, DOE believed that a sale was very possible. DOE relied quite heavily on this prospective sale in deciding on the more expensive operational option, as evidenced by the October 7, 1976, decision memorandum:

"We feel that the possibility of an eventual sale of 220-520 tons of heavy water to New Brunswick is fairly good and, therefore, believe we should delay taking action to partially shut down the plant as of October 1, 1976."

But in a September 27, 1977, letter from the Canadian Government, DOE was informed that the Canadian Government had denied New Brunswick permission to import heavy water because heavy water produced in Canada could meet New Brunswick's requirements. Canada has already built several heavy water plants of its own and has others under construction. Canada intends to become self-sufficient and any purchases from the United States would have represented temporary measures to make up for any production shortfalls experienced by Canada.

#### Pharmaceutical firm

DOE indicated that there was a potential demand from a pharmaceutical firm because of a July 2, 1976, letter it received from a research laboratory. The letter stated that the laboratory was working on a new antibiotic which the laboratory believed could pass the evaluation programs for new medicines in 4 to 5 years. If and when the antibiotic successfully passed these tests, the letter continued, annual projected needs for heavy water could be 50 to 100 tons.

We talked to officials of this laboratory about their potential heavy water needs and the progress of their antibiotic. They said that the drug does not look as promising now as it did 1-1/2 years ago and, consequently, the requirements for heavy water are even less firm than they were earlier. However, the laboratory will conduct further research before finally deciding whether the drug has any potential use. It should be noted, however, that the firm believed that heavy water could be obtained from other sources--such as Canada or Norway--if the drug were successfully developed.

#### Potential military demand

In addition to the firm demand for heavy water that is related to military purposes, DOE pointed to a potential military demand that is classified and cannot be described in this report. However, we can state that if this potential demand ever becomes a reality--which will not be known for several years--the Savannah River Plant would not be able to produce sufficient amounts of heavy water to satisfy the demand. Consequently, another plant would have to be built.

Current heavy water inventory

Another important consideration in deciding the best way to operate the plant should be the inventory of heavy water. According to DOE, the current finished inventory of heavy water consists of 764 metric tons, of which 573 tons are earmarked for the following purposes.

Held in reserve in case two heavy water "production" reactors must be started up to produce materials for military purposes	454
Unique quality heavy water used for research	119

The remaining 191 tons are excess and available for any use.

The two so-called production reactors have not been operated since the 1960s. DOE has no plans to start these reactors in the immediate future. It should be noted that DOE also has other production reactors in a standby condition at its Hanford facility that do not need heavy water to operate. DOE is now reconsidering the advisability of keeping these Hanford reactors in a standby condition because they would require significant amounts of time and money to get ready for operation.

CURRENT DOE ACTION

During our review, DOE began to reassess the situation of heavy water demand and production options. As part of the reassessment, DOE is looking at the feasibility of various options, including either shutting down the entire plant immediately or operating the plant at full capacity until its inventory can be built up and then shutting down the plant.

Many questions remain to be answered before DOE can select an alternative. These questions involve costs of the various alternatives, costs to replace the plant, military needs, potential of commercial heavy water reactors in this country, and long-term financial decisionmaking. DOE expects to answer these questions and arrive at a decision in April 1978.

CONCLUSIONS AND OBSERVATIONS

In our view, continuing to operate the plant under the current option cannot be justified. The possible sale to the New Brunswick Electric Power Commission has been negated.

The potential sale to the pharmaceutical firm has diminished, and even if the firm did need heavy water, it could seek other sources. The potential military demand is not and never was a valid justification for the current option because the plant would not be able to produce enough heavy water for this demand.

Even though we believe that the current option is not justified, we cannot support the other option that was considered in the fall of 1976, that is shutting down two-thirds of the plant. It may be more beneficial to shut down the entire plant--immediately or in several years. We cannot evaluate these alternatives, however, because DOE is in the process of answering the basic questions that must be addressed to begin such an evaluation.

AGENCY COMMENTS

Because of time constraints, we did not obtain written comments from DOE on this report. It was, however, discussed with DOE officials who were in general agreement.

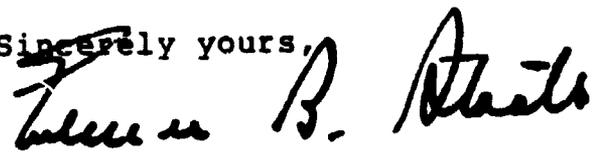
MATTER FOR CONSIDERATION  
OF THE CONGRESS

We intend to stay abreast of DOE's activities on this issue. Because of the significant cost savings that are possible, DOE should develop the basic information and choose an alternative as quickly as possible. Moreover, because of your interest and responsibility in this area, we recommend that your Subcommittee require DOE to advise you of its decision and its justifications supporting that decision as soon as possible.

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As arranged with your office, we are sending copies of this report to interested parties and to others upon request.

Sincerely yours,



Comptroller General  
of the United States